International Journal of Orthopaedics Sciences

Yousef Alghamdi
Teaching Assistant, MRCS (ed),
Orthopedic Resident,
Department of Surgery, Faculty
of Medicine, Albaha University,
Saudi Arabia

Hassan Mohammed
Orthopedic Resident, MBBS,
King Fahad Hospital, Albaha,
Saudi Arabia

Abdul Wahab Al Zahrani
Assistant Prof; Consultant,
Pediatric Orthopedic &
Deformities, Department of
Surgery, Faculty of Medicine,
Albaha University, Saudi Arabia

Acetabular center-edge angle and prevalence of acetabular dysplasia among adult residents of Albaha province, Saudi Arabia, a hospital-based cross-sectional study

Yousef Alghamdi, Hassan Mohammed and Abdul Wahab Al Zahrani

DOI: https://doi.org/10.22271/ortho.2020.v6.i3g.2228

Abstract
Background: Center-edge angle of Wiberg has been used for a long time to assess femoral head coverage by the acetabulum. However, only few studies have measured this angle in the Saudi population. Furthermore, there are very few studies conducted to study the influence of wither the tribe which an individual belongs to can affect the value of this angle.
Purpose: To establish a normal value of center-edge angle of the hip in adult Saudi resident of Albaha region, Saudi Arabia, and to determine whether certain variables such as age, gender, side of hip and tribe affect Center-edge angle.
Study design: Cross-Sectional study, Level 3 evidence.
Methodology: The center-edge angle of the acetabulum of 436 patients (872 hips) was measured. The association between the value of this angle and the patient's age, gender, side of the hip, and the tribe was studied. The prevalence of acetabular dyspepsia based on this angle was also calculated.
Results: The mean center-edge angle was 38.96˚ (±5.89˚). There was a statistically significant relationship between age and the mean value of the center-edge angle. There was no statistically significant relationship between the value of center-edge angle and gender, side of the hip, or tribe of the patient.
Conclusion: The value of the center-edge angle in our study group was higher than what was reported by Wiberg and the previous studies. It was found that there is a proportional relationship between age and value of the center-edge angle. The prevalence of acetabular dysplasia in our study group was very low compared to previous studies.

Keywords: Center-edge angle, acetabular dyspepsia, Saudi population

Introduction
Center-edge angle (CEA) of Wiberg has been used for decades to assess femoral head superior and lateral coverage by acetabular roof. This angle is used to diagnose and assess the treatment of acetabular dysplasia (AD) along with other radiographic measurements [1, 2]. However, very few studies have been carried out on this area focusing on the Saudi population. Furthermore, most of the studies did not consider tribal differences as a potential factor for variation in the mean value of CEA.
Acetabular dysplasia is a structural abnormality that is included in the spectrum of developmental dysplasia of the hip. These structural abnormalities make the acetabulum shallow and lead to under coverage of the femoral head [1]. AD is considered one of the causes of secondary osteoarthritis (OA) of the hip joint and is estimated to cause 20% to 40% of all hip OA cases [1, 2].
This study aims to establish a normal value of center-edge angle of normal hips in adult residents in Albaha province and to determine whether age, gender, tribe, and side of hip could affect the value of this angle. Also, this research aims at finding out the prevalence of acetabular dysplasia in the adult hips of the study group.

Corresponding Author:
Yousef Alghamdi
Teaching Assistant, MRCS (ed),
Orthopedic Resident,
Department of Surgery, Faculty
of Medicine, Albaha University,
Saudi Arabia

Material and Methods
Patients
Anteroposterior (AP) X-Ray view of the pelvis including both hip joints of all patients attended the radiology department in King Fahad Hospital in Albaha province, Saudi Arabia, in the period between June and December 2019 for reasons not related to hips or bony issues, were retrieved from picture archiving and communication system (PACS). Among these radiographs, 436 pelvic AP views (872 hip joints) were included in this study as they met the study inclusion criteria of being Saudi, aged 18 years or above, has no history of previous hip or pelvic fracture and have appropriate pelvic AP X-Ray view. Besides obtaining these radiographs to measure CEA, other data were obtained including the age of the patient and tribe which he/she belongs to.

Measurement of CEA
The CEA was measured as described by Wiberg [2]. Simply this angle is formed by the intersection of two lines, the first line from the center of femoral head perpendicular to pelvic transverse axis line and second line from the center of the femoral head to the most lateral bony edge of the acetabulum. The center of the femoral head is determined by using a transparent plastic template with circles of different sizes and known centers. After identifying the center, the angle of both sides was measured using the PACS tool of measuring angles.

Prevalence of AD
As suggested by Wiberg, AD is diagnosed with CEA less 20°, and borderline between 20° and 25°, and for CEA above 25, it was considered normal.

Statistical Analysis
The data obtained in this study were entered and analyzed using Statistical Package for the Social Sciences (SPSS). A t-test was used to find the association between CEA and gender and the side of the hip. While ANOVA test was used to find the relationship between different age groups and also between tribes. A p-value < 0.05 was considered to be significant.

Results
Descriptive data
This study included 436 patients (872 hips). The mean age of the patient was 45.83 years with an age range between 18 years and 99 years. There were 246 Men (56%) and 190 Women (43.6%) in the study. Of all participants, 163 (37.4%) of patient belonged to Alghamdi tribe, while 213 of them (48.9%) belonged to Alzahrani tribe and 60 (13.8%) belonged to other tribes. As shown in (table 1)

Table 1: Shows the distribution of sample subject according to gender and tribe

	Male	Female	Total
Alghamdi	92	71	163
Alzahrani	121	92	213
Others	33	27	60
Total	246	190	436

The overall mean central edge angle was 38.96° (±5.89°) with a range between 16.6° and 60.1°. The mean Central edge angle of the right hips was 38.27 (±6.55) and range between 19.5°and 60.1° and left hip was 39.65 (±6.39) and range between 16.6° and 59.7° shown in (Table 1)

Table 2: Shows the mean CEA of the right and left hips as well as the overall mean of CEA and the highest and lowest value of CEA

	Overall mean CEA	Highest CEA	Lowest CEA
All hips CEA	38.96° (±5.89°)	60.1°	16.6°
Right hip CEA	38.27 (±6.55)	60.1°	19.5
Left hip CEA	39.65 (±6.39)	59.7°	16.6°

Association with a side of the hip
There was a statistically significant difference between right and left hips CEA (p = 0.86)

Association with gender
Female participants had marginally statistically insignificant higher mean central edge angle 38.64 (±6.46) than male participants 37.98 (±6.61) (p=.301)

Association with Age
We observed a statistically significant increase in mean center edge angle with an increase in age (p =.000) on all hips and in right and left hips as measured independently. The overall mean central edge angle of the hip among patents whose age ranges from 18-30 was 37.31 (± 5.67) followed by 31-45 age group 37.8 (± 6.30), 46-60 age group 40.11(± 6.227), 61-75 age group 40.61 (±5.585), and for patients who are above 75 years 42.26 (±4.50). (Table 2) and (figure 1).

Table 3: Shows the mean CEA for each age group, as noticed the CEA increases with increase of age group

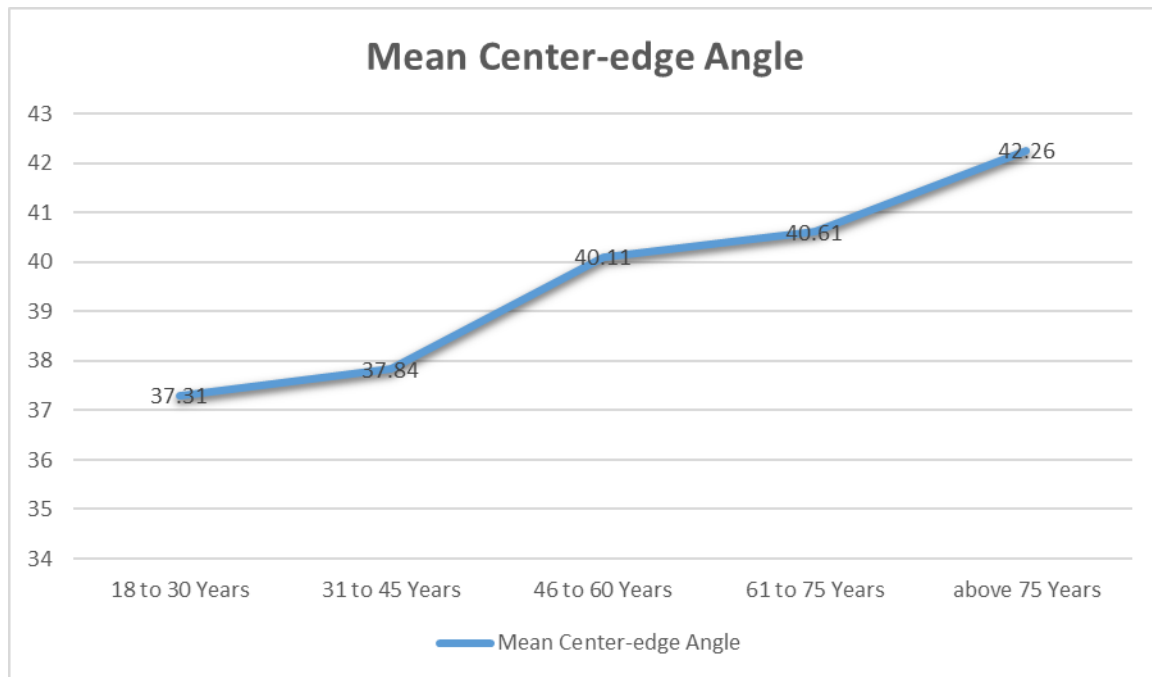| Age group	Overall mean CEA
18 to 30 years	37.31° (± 5.67)
31-45 years	37.8° (± 6.30)
46-60 years	40.11° (± 6.227)
61-75 years	40.61° (±5.585)
Above 75 years	42.26° (±4.50)

Fig 1: Shows the increase in mean CEA with increase in age group of study sample

Association with Tribe
The mean central edge angle of the hip among patients who belong to Alghamdi tribe was 39.8 (±5.89), and for those who belong to Alzahrani tribe 38.87 (±5.68), while the mean scores of patients belong to other tribes was 38.93 (±6.68). There was no statistically significant difference in central edge angle attributed to the tribes which participant belong (p = 0.942)

Prevalence of acetabular dysplasia
Out of 436 patients, there were 7 patients (10 hips) had CEA less than 25˚, three of them had bilateral hips < 25˚, while the other four patients had only right hip < 25˚. Only one patient CEA < 20˚ and it was bilateral. This result showed that the prevalence of AD is very rare.

Discussion
The findings from this study showed that the mean CEA of our study group is about 39˚. This result is higher than what was reported in a previous study in the Saudi population which showed that it was 33˚ [3] and higher than what Wiberg found in his study [4]. This discrepancy in result might be attributed to the small size in these studies. Also, these studies did not take in to account tribal diversity into account as this might affect the value of CEA. However, Other studies have shown similar results, as in the Jordanian population which was 38˚ [5]. Findings from other populations ranged between 30˚ to 36˚ [4, 6-8].
The study showed that age has an influence on the value of the center-edge angle of the acetabulum as an increase in the age there was an increase in the mean CEA. This association is also was noticed in other studies [4, 8] However there was no evidence of statistically significant that gender, side of the hip, or tribe which the individual belongs to, affects the value of the center-edge angle. This result also suggested by other studies [3, 4, 7, 8]
Our study found only one case of AD with bilateral hip CEA less than 20˚, there was 6 patient with borderline CEA (Between 20 and 25). This means that the prevalence of AD is very rare, this result also reported by a previous study in the Saudi population [3]. However, the prevalence of acetabular

dysplasia varies in published studies as there are no unified criteria to diagnose acetabular dysplasia. Some other studies diagnosed with acetabular dysplasia using a center-edge angle showed similar results as in the south Asian population [4], Chinese population [9]. Other studies showed higher prevalence [10, 11].
The limitation of this study is mainly related to the sampling technique and design. The sample was a convenience sample and hospital-based which has the disadvantage of being less representative of the study population. Also, this study only included asymptomatic patients, this could underestimate the prevalence of AD. Future studies are required to overcome these issues and to provide more reliable results than would overcome these limitations.

Conclusion
We conclude that mean value of CEA of Saudi population in our area is higher than what was reported by Wiberg and similar to other studies in nearby regions. The CEA mean value is proportionally related to age and not affected by the gender, side of the hip, or tribe of the individual. Also, the prevalence of CEA is very rare in our study group.

References
1. Gala L, Clohisy JC, Beaulé PE. Hip Dysplasia in the Young Adult: J Bone Jt Surg. 2016; 98(1):63-73.
2. Pun S. Hip dysplasia in the young adult caused by residual childhood and adolescent-onset dysplasia. Curr Rev Musculoskelet Med. 2016; 9(4):427-34.
3. Moussa M, Alomran A. Acetabular dysplasia in adult hips of a Saudi population. A possible relation to coxarthrosis. Saudi Med J. 2007; 28(7):1059-61.
4. Umer M, Sepah YJ, Asif S, Azam I, Jawad MU. Acetabular morphometry and prevalence of hip dysplasia in the South Asian population. Orthop Rev. 2009; 1(1):e10.
5. El-Heis M, Gharaibeh M, Al-Omari M, Khasawneh R. The centre edge angle of wiberg of acetabulum in adult jordanian population. MOJ Orthop Rheumatol [Internet]. 2018 Apr 20 [cited 2020 Jul 23];10(2). Available from: https://medcraveonline.com/MOJOR/the-centre-edge-

angle-of-wiberg-of-acetabulum-in-adult-jordanian-population.html

6. Yoshimura N, Campbell L, Hashimoto T, Kinoshita H, Okayasu T, Wilman C *et al*. Acetabular dysplasia and hip osteoarthritis in Britain and Japan. Br J Rheumatol. 1998; 37(11):1193-7.

7. Fischer CS, Kühn JP, Ittermann T, Schmidt CO, Gümbel D, Kasch R *et al*. What Are the Reference Values and Associated Factors for Center-edge Angle and Alpha Angle? A Population-based Study. Clin Orthop. 2018; 476(11):2249-59.

8. Shi YY, Liu TJ, Zhao Q, Zhang LJ, Ji SJ, Wang EB. The normal centre-edge angle of Wiberg in the Chinese population: a population-based cross-sectional study. J Bone Joint Surg Br. 2010; 92(8):1144-7.

9. Tian F-D, Zhao D-W, Wang W, Guo L, Tian S-M, Feng A *et al*. Prevalence of Developmental Dysplasia of the Hip in Chinese Adults: A Cross-sectional Survey. Chin Med J (Engl). 2017; 130(11):1261-8.

10. Mosler AB, Crossley KM, Waarsing JH, Jomaah N, Weir A, Hölmich P *et al*. Ethnic Differences in Bony Hip Morphology in a Cohort of 445 Professional Male Soccer Players. Am J Sports Med. 2016; 44(11):2967-74.

11. Johnsen K, Goll R, Reikerås O. Acetabular dysplasia in the Sami population: a population study among Sami in north Norway. Int J Circumpolar Health. 2008; 67(1):149-55.